Remarks

Rejections Under 35 U.S.C. § 102(e)

The Examiner has rejected claims 18-25 as anticipated under 35 U.S.C. § 102(e) in view of United States patent number 6,460,964 issued to Osborne, hereinafter referred to as Osborne. The Applicant respectfully requests careful consideration of the following explanations regarding the rejections of claims 18-25 under 35 U.S.C. § 102(e).

Rejections of Claims 18-19 Under 35 U.S.C. § 102(e)

Claim 18 includes the limitations of "determining ***a voltage of a fluid-ejection nozzle over time*** as the fluid-ejection nozzle attempts to eject fluid" and "***determining*** whether ***the voltage of the fluid-ejection nozzle*** at a predetermined time after the fluid-ejection nozzle began to attempt to eject the fluid ***exceeds a threshold***". (emphasis added) On pages 2-3, item 4 of the office action, the Examiner seems to suggest that subject matter upon which limitations of claim 18 read are disclosed in column 7, lines 21-66 and column 9 of Osborne. The Applicant respectfully disagrees that the sections of Osborne cited by the Examiner disclose subject matter upon which the limitations of claim 18 recited above read. Column 7, lines 21-66 of Osborne discloses:

> FIG. 3 illustrates one form of a thermal monitoring system 100, constructed in accordance with the present invention. The thermal monitoring system 100 uses the thermal signature created during the ejection, or attempted ejection, of ink droplets 99 to determine whether or not a droplet was indeed ejected in response to a firing pulse received from the controller 35. The monitoring system 100 may be done "on-the-fly," that is, during a normal fluid ejection or printing routine, without requiring unnecessary time to be wasted while the printhead is positioned at a special sensor in the servicing region 48 as was the case with earlier systems discussed in the Background section above. Furthermore, monitoring nozzle health, and substituting functioning nozzles for non-functioning nozzles on-the-fly allows the printer 20 or other fluid ejection mechanism to make needed corrections so the ultimate job is not affected by any non-functioning nozzles.

The thermal monitoring system 100 may be started during any one of several initiating activities 102, such as during normal printing 104, during a normal nozzle purging or spitting routine 106, or during a special nozzle checking routine 108. When either of these initiating activities 104, 106 or 108 occurs, signals are sent by the printer controller 35 to a firing pulse generator 110, which applies a firing voltage across a selected resistor 95. ***In the time frame during which the selected resistor 95 is expected to fire, in a measuring step 112 the <u>change in the resistance of the fired resistor is measured</u> over time.*** Following this resistance measurement, in a converting step 114, an analog to digital (A/D) conversion is made of the resistance measured in step 112. ***This <u>change in resistance</u> of the fired resistor 95 over time <u>may be plotted</u> as curve 115, shown in the graph of FIG. 4.*** Following generation of the trace 115, a signal analysis step 116 is performed as described further below with respect to FIG. 4.

In a determination step 118, the determination is made whether the resulting curve, such as 115 in FIG. 4, is a good signal, indicating a properly functioning nozzle 90. If a good signal is indeed found by step 118, a YES signal 120 is issued to a continuing step 122, where normal fluid ejection is then continued using the properly functioning nozzle 90. However, when a good signal is not found by the determination step 118, a NO signal 124 is issued. The next operation performed depends upon what particular initiating steps 104-108 were occurring when the selected nozzle 90 was being checked. (emphasis added)

Column 9 of Osborne discloses:

characteristics of the fired resistor shown in FIG. 4. The curve 115 illustrates the operation of a properly functioning nozzle 90 ejecting a fluid droplet 99. This curve 115 has several different segments and sections. The time zero (0) seconds indicates when the firing signal is first delivered by controller 35 to the resistor 95. Prior to time zero, the resistor 95 has an ambient temperature curve section 158 which is shown as approximately room temperature. ***Following application of the firing pulse, the <u>resistor temperature</u> begins to rise as shown by a first arced section 160, followed by a second arced section 162, until reaching a maximum temperature of approximately 330.degree.*** C shortly before eight seconds have elapsed since the firing pulse was initiated at time zero. ***Following this maximum <u>temperature</u>, the curve 115 then rapidly drops in <u>temperature</u>***, as shown for curve section 164

until again returning to ambient temperature before the nine-second point in time.

During the first arced portion 160 of curve 115, energy from the resistor 95 is being transferred to the liquid surrounding the resistor, here ink. The second arced portion 162 of curve 115 shows the heat transfer where the resistor 95 is now heating the gas bubble being formed as the liquid boils. A properly functioning nozzle will generate a thermal characteristic having a transition 165, where the two-arced curve sections 160 and 162 join. During this transition phase 165, the air bubble is formed as the liquid, here ink, begins to boil. When the gas bubble eventually bursts, the ink droplet 99 is then ejected from the nozzle 90, shown at a knee portion 166 of curve 115 where curve portions 162 and 164 join together.

Thus, the good signal determining step 118 looks for the transition 165 of curve 115, which may occur over a region of approximately a second, somewhere between three and five seconds as shown in FIG. 4 for the illustrated printhead 70. In determining whether the transition point 165 exists, the first and second arced curve sections 160 and 162 may be mathematically approximated as straight-line traces. For instance, when the resistor 95 is heating the gas bubble, the curve 162 may be approximated by a straight-line curve 168. Similarly, when the resistor 95 is heating the liquid, the first arced curve 160 may be approximated by a straight-line curve 170. When an intersection 172 between these two mathematical curve approximations 168 and 170 is encountered, step 118 then determines that indeed a gas bubble has formed and the nozzle 90 is functioning properly. The mathematical approximations of generating curves 168 and 170 to determine whether the inflection point 172 occurred is preferred over a graphical analysis of the raw data because it is easier to detect point 172 than the actual signal inflection portion 165 of curve 115.

Thus, operation of the good signal determination step 118 is now understood. As mentioned above, the thermal characteristics of FIG. 4 may also be used by the determining step 138 to determine which type of blockage, solid or air has been encountered. Knowing the type of nozzle blockage then is used to determine which type of nozzle recovery routine is performed, either the wiping/solvent application routine 144, the priming routine 150, or positive pressure application routine 154. For instance, a solid blockage may be found when there is no transition 165 within the trace 115. During a solid nozzle blockage episode, the resistor 95 heats up along the first arced portion 160, and then instead of transitioning at point 165, the ***temperature*** continues on as shown for curve 174,

> where the heat continues to be dissipated into the liquid without a bubble eruption occurring, such as at point 166 of curve 115. Thus, when the nozzle thermal characteristic follows the path of curve 174, (emphasis added)

Thus, the subjected matter disclosed in the portion of column 7 of Osborne identified by the Examiner does not appear to disclose subject matter upon which the limitations of claim 18 of "determining a voltage of a fluid-ejection nozzle over time" and of "determining whether the voltage of the fluid-ejection nozzle . . . exceeds a threshold" read. That is, this cited section of Osborne discloses subject matter relating to measuring a "change in the resistance" rather than subject matter upon which the limitations of claim 18 recited above read. Additionally, the subject matter disclosed in column 9 of Osborne does not appear to disclose subject matter upon which the limitations of claim 18 of "determining a voltage of a fluid-ejection nozzle over time" and of "determining whether the voltage of the fluid-ejection nozzle . . . exceeds a threshold" read. Rather column 9 of Osborne discloses subject matter relating to "resistor temperature". If the Examiner contends that subject matter is disclosed in Osborne upon which the limitations of claim 18 recited above read, the Applicants respectfully request that the Examiner specifically identify the location of this disclosure within Osborne and distinctly explain why the Examiner regards these limitations of claim 18 as reading upon this disclosure.

As the Applicant knows that the Examiner is certainly aware, MPEP 2131 requires that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference". Because the sections of Osborne cited by the Examiner do not disclose all the limitations of claim 18, the Applicants respectfully submit that a valid prima facie anticipation rejection of claim 18 with respect to Osborne is not present for at least this reason. Accordingly, the Applicants respectfully request withdrawal of the rejection of claim 18 under 35 U.S.C. § 102(e).

Claim 19 is dependent upon claim 18 and therefore incorporates all the

limitations of claim 18. For at least the reason that a valid prima facie anticipation rejection of claim 18 is not present with respect to Osborne, a valid prima facie anticipation rejection of claim 19 is not present with respect to Osborne. Accordingly, the Applicants respectfully request withdrawal of the rejection of claim 19 under 35 U.S.C. § 102(e).

Rejections of Claims 20-21 Under 35 U.S.C. § 102(e)

The amended claim 20 includes the limitations of "a mechanism to compare a predetermined profile of firing resistance over voltage to individual of profiles of firing resistance over voltage determined for corresponding of the plurality of thermal fluid-ejection nozzles to detect clogging". Because claim 20 has been amended to include limitations related to those recited in claim 1, indicated by the Examiner has containing allowable subject matter, the Applicant respectfully submits that the amended claim 20 is in a condition for allowance. Accordingly, the Applicant respectfully requests withdrawal of the rejection of claim 20 under 35 U.S.C. § 102(e). Claim 21 is dependent upon the amended claim 20 and therefore includes all the limitations of the amended claim 20. For at least the reason that a valid prima facie anticipation rejection of the amended claim 20 with respect to Osbome is not present, a valid prima facie anticipation rejection of claim 21 with respect to Osbome is not present.

Rejections of Claims 22-23 Under 35 U.S.C. § 102(e)

Claim 22 includes the limitations of "a mechanism to determine whether any of the plurality of fluid-ejection nozzles of the at least one fluid-ejection mechanism has clogged ***by determining a voltage of each fluid-ejection nozzle over time as the fluid-ejection nozzle is fired***". (emphasis added) As explained in detail with respect to the rejection of claim 18, the Applicant respectfully submits that subject matter is not disclosed in the sections of Osbome relied upon by the Examiner in making the rejection of claim 22 upon which the limitations of "a mechanism to determine whether any of the plurality of fluid-ejection nozzles of the at least one fluid-ejection mechanism has clogged by

determining a voltage of each fluid-ejection nozzle over time as the fluid-ejection nozzle is fired" read.

Because the sections of Osborne cited by the Examiner do not disclose all the limitations of claim 22, the Applicants respectfully submit that a valid prima facie anticipation rejection of claim 22 with respect to Osborne is not present for at least this reason. Accordingly, the Applicants respectfully request withdrawal of the rejection of claim 22 under 35 U.S.C. § 102(e). Claim 23 is dependent upon claim 22 and therefore incorporates all the limitations of claim 22. For at least the reason that a valid prima facie anticipation rejection of claim 22 is not present with respect to Osborne, a valid prima facie anticipation rejection of claim 23 is not present with respect to Osborne. Accordingly, the Applicants respectfully request withdrawal of the rejection of claim 23 under 35 U.S.C. § 102(e).

Rejections of Claims 24-25 Under 35 U.S.C. § 102(e)

Claims 24 and 25 have been canceled without disclaimer or waiver of the subject matter of these claims. Accordingly, the rejections of claims 24 and 25 have been rendered moot.

Allowed Claims

The Examiner has allowed claims 1-17.

Conclusion

The Applicants respectfully contend that claims 1-3, 5-7, 9-10, and 12-23are in a condition for allowance. Such allowance is respectfully requested.

Respectfully submitted,
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